

## CLAIMS

1. A system for communicating patient device information to and from a medical device implanted in an ambulatory patient and with a remote medical support network comprising:

an implanted device telemetry transceiver within the implanted medical device for communicating data and operating instructions to and from the medical device the implanted device telemetry transceiver having a tranceiving range extending outside the patient's body a distance sufficient to receive and transmit such telemetered communications; and

an external patient communications control device adapted to be located in relation to the patient within the device tranceiving range including:

a system controller for facilitating communications with the implanted medical device;

an implant wireless interface including a control device telemetry transceiver for receiving and transmitting coded communications between the system controller and the implant device telemetry transceiver;

a global positioning system coupled to said system controller for providing positioning data identifying the global position of the patient to the system controller; and

communications means for communicating between the external communications control device and a remote medical support network.

2. The system of Claim 1 further comprising:

communications network interface means coupled to the system controller and the communications means for selectively enabling the communications means for transmitting the positioning data to the medical support network and for selectively receiving commands from the medical support network wherein said implantable wireless interface includes a real time clock and a system for updating said real time clock based on accurate time clock information in signals received from said global positioning system..

Claim 3. An emergency patient location system comprising:

a transceiver unit to be located in immediate proximity to a patient's body for communicating with a device implanted in the patient's body and with a telephone system outside the patient's body,

the transceiver unit comprising,

a GPS location system for receiving satellite location information from a set of earth orbiting satellites,

an IMD receiving telemetry circuit means for receiving telemetry from said implanted device,

a memory circuit for storing data relating to data received from said implanted device and from said earth orbital satellite,

telecommunications module for communication through wireless telephonic channels to said telephone system which may be associated with emergency response systems, and

circuit means for producing a representation of said received location information for presentation to said telecommunications module so that said telecommunications module can transmit said representation of said location information to location receiving means in said emergency response systems.

4. An emergency patient location system as set forth in claim 3 said transceiver unit further comprising;

DGPS receiver means for receiving DGPS signals from a base station, and wherein said circuit means for producing a representation of said received location information for presentation to said telecommunications module is configured to also provide DGPS information to said telecommunications module.

5. An emergency patient location system as set forth in claim 3 said transceiver unit further comprising;

dead reckoning circuit means for determining the relative location of said transceiver unit over time to any location at a fixed time during which an acceptable

fixed location of said transceiver unit is known, and wherein said circuit means for producing a representation of said received location information for presentation to said telecommunications module is configured to also provide a representation of said dead reckoning information to said telecommunications module.

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6. An emergency patient location system as set forth in claim 5 said transceiver unit further comprising;

a distance traveled interpretive processor for receiving an output from said dead reckoning circuit and determining a distance traveled therefrom,

10 a trigger circuit for triggering the initiation of transmission to said telephone system by said telecommunications module when the distance traveled interpretive processor determines a distance traveled is greater than a predetermined trigger distance value.

15 7. An emergency patient location system as set forth in claim 3 further comprising a processor adapted for transmitting emergency information from said transceiver unit to an emergency E911 system.

20 8. A patient monitoring system comprising:

a transceiver unit to be located in immediate proximity to a patient's body for communicating with a device implanted in the patient's body and with a telephone system outside the patient's body, the transceiver unit comprising,

25 a GPS location system for receiving satellite transmitted information from a set of earth orbiting satellites,

an IMD receiving telemetry circuit means for receiving telemetry from said implanted device,

a memory circuit for storing data relating to data received from said implanted device and from said earth orbital satellite,

30 telecommunications module for communication through wireless telephonic channels to said telephone system,

real time clock circuit producing an output signal for a real time clock,  
 transmission initiation processor for generating an automatic transmission  
 over said telecommunications module through said wireless telephonic channels  
 containing information related through said implantable device to said transceiver  
 5 unit, said automatic transmission to occur at a set of periodically occurring fixed  
 times, and

real time clock circuit update processor for interpreting received satellite  
 transmitted information and providing an update for the real time clock circuit based  
 on said satellite transmitted information so that said transmission initiation processor  
 10 can operate within an extremely accurately clocked time slice.

<sup>2</sup>  
~~9~~. A patient monitoring and emergency location system comprising;

a patient monitoring system as set forth in claim 8 and further comprising;  
 circuit means for producing a representation of said received satellite  
 15 information relating the location of said transceiver unit for presentation to said  
 telecommunications module so that said telecommunications module can transmit  
 said representation of said location information to location receiving means in an  
 emergency response system connected to said telephone system.

<sup>3</sup>  
~~10~~. A patient monitoring and emergency location system as set forth in claim 9<sup>2</sup> said  
 20 transceiver unit further comprising;

DGPS receiver means for receiving DGPS signals from a base station, and  
 wherein said circuit means for producing a representation of said received location  
 information for presentation to said telecommunications module is configured to  
 25 also provide DGPS information to said telecommunications module.

<sup>4</sup>  
~~11~~. A patient monitoring and emergency location system as set forth in claim 9<sup>2</sup> said  
 30 transceiver unit further comprising;

dead reckoning circuit means for determining the relative location of said  
 transceiver unit over time to any location at a fixed time during which an acceptable  
 fixed location of said transceiver unit is known, and wherein said circuit means for

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producing a representation of said received location information for presentation to said telecommunications module is configured to also provide a representation of said dead reckoning information to said telecommunications module.

5 12.5 A patient monitoring and emergency location system as set forth in claim 9, 2  
said transceiver unit further comprising;

a distance traveled interpretive processor for receiving an output from said dead reckoning circuit and determining a distance traveled therefrom,

10 a trigger circuit for triggering the initiation of transmission to said telephone system by said telecommunications module when the distance traveled interpretive processor determines a distance traveled is greater than a predetermined trigger distance value.

13.6 A patient monitoring and emergency location system as set forth in claim 9, 2  
15 further comprising a processor adapted for transmitting emergency information from said transceiver unit to an emergency E911 system.

14.7 Emergency response system for receiving location information from a  
20 transceiver unit in proximity to a patient with an implantable medical device in communication with said transceiver unit, said emergency response system comprising;

25 at least one mobile unit operational on an emergency basis for receiving location information from said transceiver unit and having a GPS system and a computer system therein, such that said mobile unit GPS system produces data related to a present location of said mobile unit and makes said data related to said present location of said mobile unit available to said computer system and said mobile unit computer system comprises processor means for processing said received location information from said transceiver unit and said data related to the present location of said mobile unit to produce an indication of the relative position  
30 of said transceiver unit to said mobile unit, and

a base station for receiving through a telephone system a current location representation from said transceiver unit along with status information related to an implantable device implanted within a patient associated with said transceiver unit.

5 <sup>8</sup> 15. Method for operation of a transceiver unit for wearing on a person having location means and means for communicating with an implant and with a telephone network comprising:

10 providing a telemetric communications pathway between an implanted medical device(IMD) and a patient word device(PWD) to facilitate the transfer from the IMD to the PWD of data relating to any of the following information types: a. Serial No. or other unique ID data, b. Patient Condition, c. Device status data, d. Device Sensor data, and/or e. coordinating data,

15 providing a telemetric communications pathway between an IMD and a PWD to facilitate the transfer from the PWD to the IMD of data relating to any of the following information types: a. Commands and /or b. Coordinating data,

20 providing a telemetric communications pathway between a node on a telephone network and said PWD and between a satellite GPS system and said PWD so as to facilitate the transfer of any of the following information types from said node and/or said satellite GPS system to said PWD: a. Command data and/or coordinating data, and

25 providing a telemetric communications pathway between a node on a telephone network and said PWD so as to facilitate the transfer of any of the following information types from said PWD to said node: PWD device data including any data received by the PWD from the IMD and/or any sensor data that may be developed and stored by the PWD and/or PWD status data and/or Dynamic Relative Reference data from a dead reckoning system associated with said PWD, and GPS and DGPS which may be stored by the PWD.

30 <sup>9</sup> 16. A method as set forth in claim 15 <sup>8</sup> and further comprising

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determining when said tranceiving unit has traveled a predetermined distance  
and

upon said determination of having traveled said predetermined distance,  
initiating a telephonic contact to a node on said telephone network.

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~~17~~<sup>10</sup>. A method as set forth in claim ~~15~~<sup>8</sup> and further comprising:  
awaiting a determination of an emergency condition having occurred,  
then initiating a telephonic contact to at least one node on said telephone  
network when as emergency condition has arisen.

10

~~18~~<sup>11</sup>. A method as set forth in claim ~~17~~<sup>10</sup> and further comprising:  
sending coded data regarding the nature of the emergency to said at least one  
node.

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~~19~~<sup>12</sup>. A method as set forth in claim ~~17~~<sup>10</sup> and further comprising:  
sending location data regarding the location of the PWD to said at least one  
node.

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~~20~~<sup>13</sup>. A method as set forth in claim ~~15~~<sup>8</sup> and further comprising:  
awaiting a determination of an emergency condition having occurred,  
then initiating a telephonic contact to an emergency system including a  
system of the two systems, standard emergency system and/or to an E-911 system,  
on said telephone network when as emergency condition has arisen.

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~~21~~<sup>14</sup>. A method as set forth in claim ~~20~~<sup>13</sup> and further comprising:  
sending coded data regarding nature of the emergency to said emergency  
system.

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~~22~~<sup>15</sup>. A method as set forth in claim ~~20~~<sup>13</sup> and further comprising:  
sending location data regarding the location of the PWD to said emergency  
system.

23. <sup>46</sup> A method as set forth in claim <sup>8</sup> 15 and further comprising  
 providing a real time clock system and a clock updating system for  
 correcting the value of real time clock information based on satellite signals to said  
 transceiver unit,

automatically using the corrected real time clock values to trigger an  
 automatic turn on a communication between said PWD and a node in a narrow time  
 slice, and

reporting to said node by said PWD some or all data facilitated for transfer  
 on that communications pathway.

24. <sup>17</sup> A method as set forth in claim <sup>16</sup> 23 further comprising,  
 receiving command data from said node by said PWD during an additional  
 narrow time slice.

25. <sup>18</sup> A method as set forth in claim <sup>17</sup> 24 further comprising,  
 transmitting a representation of said command data to said IMD from said  
 PWD.

26. <sup>19</sup> A method as set forth in claim <sup>18</sup> 25 further comprising;  
 receiving said representation of said command data in said IMD,  
 programming the IMD based on said representation of said command data.

27. <sup>20</sup> A method of monitoring a patient having a transceiver associated therewith and  
 an implanted medical device in communication with said transceiver comprising;  
 monitoring GPS and DGPS location data by said transceiver,  
 interpreting said location data by said transceiver and  
 if said location data interpreted by said transceiver indicates the patient  
 transceiver is outside a predetermined area,

initiating a telephone call by said transceiver to a telephone node on a  
 telephone network, indicating the present location of said transceiver.



28. <sup>21</sup> A method of monitoring a patient having a transceiver associated therewith and an implanted medical device in communication with said transceiver comprising;

monitoring the implanted medical device for either a lack of signal over a predetermined period of time or for an alarm signal generated by said implanted medical device and

if either said alarm signal is received or if said lack of signal exists over said predetermined period of time,

automatically initiating an emergency telephone call by said transceiver to a node on a telephone network indicating an alarm condition to said node.

29. <sup>22</sup> A method of operating an emergency patient location system comprising,

providing said system with patients having implanted medical devices and transceiver units for monitoring communications from said implanted medical devices,

providing said transceiver units with means to receive GPS data and to store said GPS data,

providing said transceiver units with telecommunications equipment, awaiting the development of emergency conditions to be reported by said transceiver units to said system across telephonic communications pathways,

dispatching emergency mobile units having receiver means tuned to receive signals from said transceiver unit reporting said emergency condition

reporting from said transceiver unit location information,

receiving said location information in said emergency mobile unit and

employing said location information by said emergency mobile unit to locate the patient having the reported emergency.

30. <sup>23</sup> Method as set forth in claim <sup>22</sup> 29 further comprising continuously transmitting a signal by said transceiver unit after reporting said emergency condition and wherein said employing step includes triangulation on a signal transmitted by said transceiver unit after said transceiver unit initially reports said emergency condition .

<sup>24</sup>  
31. Method as set forth in claim ~~29~~<sup>22</sup> wherein said location information transmitted by said transceiver unit includes DGPS information.

5 <sup>25</sup>  
32. Method as set forth in claim ~~29~~<sup>22</sup> wherein said location information transmitted by said transceiver unit includes dead reckoning information.

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